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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is also included. (AG)

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TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

CARPET LAYER (ret. tr.) 7-59.220
LINOLEUM LAYER (const.; ret. tr.) 5-32.732

B-455 or S-185

U. S. Employment Service in
Cooperation with
Colorado and Oregon State Employment Services

September 1962

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GATB #2324C
August 1960

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY FOR CARPET LAYER (ret. tr.) 7-59.220 LINOLEUM LAYER (const.; ret. tr.) 5-32.752

B-455 or S-185

(Supersedes B-429)

Summary

The General Aptitude Test Battery, B-1002A, was administered to two samples of Journeymen Carpet Layers 7-59.220 and Linoleum Layers 5-32.752 in the Denver Colorado and Portland, Oregon areas. Table I below shows the year in which data collection was completed, the number included in the final sample, and the type of criterion used for validation purposes for each sample.

TABLE I

SAMPLE	YEAR	N	CRITERION
I (Colorado)	1960	54	Supervisory Ratings
II (Oregon)	1957	47	Supervisory Ratings

Data for the two samples were analyzed separately and in combination. On the basis of mean scores, standard deviations, correlations with the criteria, job analysis data, and their combined selective efficiency, aptitudes N-Numerical Aptitude, S-Spatial Aptitude, and M-Manual Dexterity were selected for inclusion in the test norms.

GATB Norms for Carpet Layer 7-59.220 and Linoleum Layer 5-32.752 - B-455 or S-185

Table II shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Carpet Layer 7-59.220 and Linoleum Layer 5-32.752.

TABLE II

Minimum Acceptable Scores on B-1001 and B-1002 for B-455 or S-185

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
N	CB-1-D CB-1-I	90	N	Part 2 Part 6	85
S	CB-1-F CB-1-H	100	S	Part 3	95
M	CB-1-M CB-1-N	80	M	Part 9 Part 10	80

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Effectiveness of Norms

The data in Table VI-C indicate that 20 of the 34 poor workers, or 59 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 59 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Morever, 56 of the 70 workers who made qualifying test scores, or 80 percent, were good workers.

I. Purpose

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupations of Carpet Layer 7-59.220 and Linoleum Layer 5-32.752.

II. Sample

This study is based on two samples of Carpet Layers 7-59.220 and Linoleum Layers 5-32.752 in the Denver, Colorado and Portland, Oregon areas. The test norms were developed on the basis of the results of both samples.

Sample I - Colorado

The GATB, B-1002A, was administered in February 1956, March 1956, March 1957, and August 1959 to a sample of 54 journeymen Carpet Layers 7-59.220 and Linoleum Layers 5-32.752 who were members of Carpet and Linoleum Union Local 419 employed in various firms in the Denver, Colorado area. The selection of the sample was on a volunteer basis with modifications established by the union. The final sample of 54 journeymen represented a wide range of ability and was proportionately representative of those workers engaged in new construction work and those engaged in repair work.

The apprenticeship period for those positions is four years; consequently, all members of this sample had had at least 48 months experience in these occupations.

Sample II - Oregon

The GATB, B-1002A, was administered during the period January 8, 1957 to June 27, 1957 to a sample of 49 journeymen Carpet Layers 7-59.220 and Linoleum Layers 5-32.752 at Linoleum Layers Union Local 1236, Portland, Oregon. The potential sample consisted of 100 journeyman. The selection of the sample was on a voluntary basis. No age limits were considered in the selection of the sample. A sixth grade education was considered a minimum. Applicants were accepted on the basis of evaluation after oral interviews made by apprenticeship committees. Applicants for apprenticeship must be at least 16 years of age and not more than 21 years except in the case of veterans and other special cases. Two journeymen were excluded from the final sample; one because he was the business agent of the union and did not actively engage in the trade and another because he was working as a dispatcher. Therefore, the final sample consisted of 47 journeymen.

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TABLE III

Number of Workers in Sample (N), Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, and Experience

Capret Layer 7-59.220
Linoleum Layer 5-32.752

	N	M	σ	Range	r
Age (years)					
Sample I - Colorado	54	36.1	9.4	24-61	-.049
Sample II - Oregon	47	39.6	7.8	25-59	-.092
Combined Sample	101	37.7	8.8	24-61	-----
Education (years)					
Sample I - Colorado	54	10.9	1.7	7-14	-.001
Sample II - Oregon	47	11.0	1.8	7-16	.213
Combined Sample	101	10.9	1.7	7-16	------
Experience (months)					
Sample I - Colorado	54	139.6	88.5	54-420	.008
Sample II - Oregon	47	161.7	94.2	48-420	-.040
Combined Sample	101	149.9	91.9	48-420	-----

There are no significant correlations between age, education, and experience for either of the two samples. The data in Table III indicate that the samples are suitable for test development purposes with respect to age, education, and experience.

Job Description

Job Title: Carpet Layer 7-59.220
Linoleum Layer 5-32.752

Job Summary: Lays blocks, strips, or sheets of floor covering such as tiles, linoleum, carpeting and rugs. When laying linoleum, cements felt base material to floor and linoleum to base material. Lays linoleum wall covering. Covers such objects as cabinets, cupboards, and desks, securing linoleum with metal strips fastened to edges. Lays, tacks, and stretches, with hand-powered stretching tools, carpeting and rugs, following floor sketches which have been previously prepared.

Work Performed: Prepares to lay floor coverings: Studies blueprints, work sketches or order specifications to determine type and size of materials to be used, kind of pattern or design to be followed, lay-out and location of installation, and sequence of operations. Calculates dimensions from work sketches and order specifications to determine most economical installation in both material and time. Removes fixtures, such as radiators, and other obstructions when necessary. Makes minor repairs

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in floor, such as filling holes, cracks or joints with "floor-stone," leveling off rough or uneven surfaces, and may smooth wood floors with a floor sander. Carries floor covering material--linoleum, tile or carpeting--to job area. (May carry up and down flights of stairs.) Arranges materials ready for use on the job.

Lays foundation material: Measures dimensions of room with a steel tape to establish guide lines for cutting and laying material and marks guide lines on floor with chalk line. Measures and cuts foundation materials, such as felt or building paper, felt waffle pad or rubber pad, using a steel tape and pocket knife.

Spreads floor-cement on floor with a trowel, lays and stretches strips or sheets of foundation material over the floor-cement, cutting and fitting around projections, corners and baseboard, and cements or tacks at edges. Presses down material by pushing and pulling a hand roller over the foundation material until it is smooth and flat on the floor.

Marks guide lines and border lines of foundation material for laying floor covering. Checks accuracy of guide lines with size of material to be laid and work order specifications, and makes any necessary corrections.

Lays floor covering: Checks accuracy of dimensions and fit of installation, and makes any necessary corrections. Places around projections and corners by measuring and visually determining shape of projection, border distance, or corner, in order to make appropriate cuts in floor covering with minimum amount of waste. Checks accuracy of cuts by test fitting into place.

For tile: Spreads floor cement on floor, using a trowel, covering a small area at a time. Starting at guide marks on floor, lays blocks on surface of floor of foundation material. Presses firmly into place, using hands. Executes designs and patterns according to blueprints and work order specifications, laying material until area bounded by border lines has been covered. Cuts and cements border strips to fit space around projections and between walls and finished floor covering, using a tile cutter for straight cuts or a knife for cutting curves and notches. May heat certain type of tile with a blow torch in order to cut. Pushes and pulls hand roller over floor surface to secure proper adhesion and smoothness of floor covering to the floor or foundation material. Visually checks finished floor covering for air bubbles and irregular thickness of tile, removing and re-setting tile when necessary, fitting, pressing and rolling into place.

For sheet linoleum, rugs and carpeting: Unrolls and stretches linoleum or carpeting into place, using hand stretching tools or hands. Pushes and pulls hand roller over floor to secure adhesion and smoothness of floor covering. Fastens edges of fitted covering by tacking to floor, by use of metal or wood molding, or by cementing. May cement entire area of linoleum or carpeting to floor or foundation material. May cement individual carpeting squares to floor or foundation material, executing designs and patterns according to work order specifications. Measures, cuts, and cements or tacks rubber or metal edging to border of open passageways. May cement tile or linoleum to walls and counter tops.

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Rubs or scrapes excess cement from surface of floor covering with gasoline, alcohol, or water, using a saturated cloth and scraper. Replaces fixtures and molding. Picks up scraps, sweeps floor, and gathers materials and tools.

IV. Experimental Battery

All the tests of the GATB, B-1002A, were administered to each sample.

V. Criterion

Sample I - Colorado

The criterion for this sample consisted of rank order ratings. The first rating was made by the business agent of the Carpet and Linoleum Union Local 419. The second rating was made by an employer, who as a former journeyman had an excellent over-all knowledge of the workers tested. The ratings were then converted to linear scores.

A correlation coefficient of .268 was obtained between the linear scores for the two sets of rank-order ratings provided for the Colorado study. When two sets of criterion data, each designed to measure the same aspects of performance, are correlated less than .60 with each other (as in the case for the Colorado study), it is likely that one of the measures is less valid or less reliable than the other. In attempting to select the better of the two sets of rank-order ratings as the final criterion, each of the sets of rank-order ratings were correlated with the variables of age, education, experience, and the aptitudes of the GATB. Neither set of ratings was significantly related to age, education or experience. Only the second set of ratings showed some significant relationships with the aptitudes of the GATB. Since it is likely that a more reliable criterion will yield higher validity coefficients, this indicates that the second set of ratings tends to be more reliable than the first set. Therefore, the second set of ratings was chosen as the final criterion for the Colorado study.

Sample II - Oregon

The criterion for this sample consisted of supervisory ratings made on a descriptive rating scale. Because workers were dispatched to employers by the union as they are needed, many of the workers were not attached to any one employer. Therefore, supervisors were selected to rate those men who had worked with them at various times on different jobs. The ratings were made on a descriptive rating scale. Re-ratings were made approximately two-months later. The final criterion used for validation purposes consisted of the sum of the scores of the first and second ratings.

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V. Qualitative and Quantitative Analyses

A. Qualitative Analysis:

The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation.

Intelligence (G) - required to learn the job tasks and subject matter to successfully complete an apprenticeship program.

Numerical Aptitude (N) - required to make accurate measurements and compute amounts and costs of materials needed and time required to complete jobs.

Spatial Aptitude (S) - required to read and interpret blueprints and sketches and to visualize layouts.

Form Perception (P) - required to execute patterns from the simple to the complex and intricate called for in the work order specifications.

Motor Coordination (K) - required to place tile pieces quickly and accurately.

Manual Dexterity (M) - required to cut tile, linoleum and carpeting.

On the basis of the job analysis data, the following aptitude is considered obviously unimportant for performing the duties of this job and is considered an "irrelevant" aptitude: V - Verbal Aptitude.

B. Quantitative Analysis:

Table IV-A shows the means and standard deviations for the aptitudes of the GATB for each sample separately and for the combined sample. The means and standard deviations are comparable to general working population norms with a mean of 100 and a standard deviation of 20 for each aptitude.

Table IV-B shows the correlation between the criterion and the aptitudes of the GATB for each sample.

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TABLE IV-A

Means (M) and Standard Deviations (σ) for the Aptitudes of the GATB for Each Sample Separately and for the Combined Sample

Carpet Layer 7-59.220
Linoleum Layer 5-32.752

Aptitudes	Sample I - Colorado N=54		Sample II - Oregon N=47		Combined Sample N=101	
	M	σ	M	σ	M	σ
G-Intelligence	105.8	15.4	109.3	15.4	107.4#	15.0
V-Verbal Aptitude	101.4	15.3	106.0	16.7	103.3#	15.9
N-Numerical Aptitude	98.4	16.0	103.4	13.3	100.3	14.6*
S-Spatial Aptitude	111.9	17.4	110.2	18.2	111.1#	17.5
P-Form Perception	99.0	14.0	97.2	17.7	98.1	15.9
Q-Clerical Perception	97.9	12.1	100.8	12.7	99.4	12.5*
K-Motor Coordination	103.5	17.7	102.2	19.3	102.5	18.5
F-Finger Dexterity	94.8	24.1	91.5	20.9	93.1	22.6
M-Manual Dexterity	100.6	23.1	108.1	24.1	104.3#	23.5

#Relatively High Mean Score
*Relatively Low Standard Deviation

TABLE IV-B

Pearson Product Correlations with the Criterion for the Aptitudes of the GATB for Each Sample

Carpet Layer 7-59.220
Linoleum Layer 5-32.752

Aptitudes	Sample I - Colorado N=54	Sample II - Oregon N=47
G-Intelligence	.200	.248
V-Verbal Aptitude	.123	.133
N-Numerical Aptitude	.354**	.260
S-Spatial Aptitude	-.016	.363*
P-Form Perception	.146	.387**
Q-Clerical Perception	.238	.169
K-Motor Coordination	.404**	.152
F-Finger Dexterity	.200	.199
M-Manual Dexterity	.338*	.222

*Significant at the .05 level
**Significant at the .01 level

For Sample I of 54 cases, correlations of .348 and .268 are significant at the .01 and .05 levels of confidence, respectively. Aptitudes N and S correlate significantly with the criterion at the .01 level. Aptitude M correlates significantly with the criterion at the .05 level.

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For Sample II of 47 cases, correlations of .372 and .288 are significant at the .01 and .05 levels of confidence, respectively. Aptitude P correlates significantly with the criterion at the .01 level. Aptitude S correlates significantly with the criterion at the .05 level.

C. Selection of Test Norms

TABLE V

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X		X	X	X		X		X
Irrelevant		O							
Relatively High Mean (N=101)	X	X		X					X
Relatively Low Sigma (N=101)			X			X			
Significant Correlation with Colorado Criterion			X				X		X
Significant Correlation with Oregon Criterion				X	X				
Aptitudes to be Considered for Trial Norms	G		N	S	P		K		M

Trial norms consisting of various combination of Aptitudes G, N, S, P, K, and M with appropriate cutting scores were evaluated against the criterion by means of the tetrachoric correlation technique. A comparison of the results showed that B-1002 norms consisting of N-85, S-95, and M-80 had the best selective efficiency.

VII. Concurrent Validity of Norms

For the purpose of computing the tetrachoric correlation coefficient between the test norms and the criterion and applying the Chi Square test, the criteria for the two samples were dichotomized. For Sample I the criterion was dichotomized by setting a criterion critical score of 42, which resulted in 18 of the 54 workers, or 33 percent of the sample being placed in the low criterion group. For Sample II the criterion was dichotomized by setting a criterion critical score of 62, which resulted in 16 of the 47 workers, or 34 percent of the sample being placed in the low criterion group.

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Tables VI-A and VI-B show the relationship between test norms consisting of N-85, S-95, and M-80, and the dichotomized criterion for Sample I and Sample II, respectively. Table VI-C, which is a composite of Tables VI-A and VI-B, shows the selective efficiency of the norms for the Combined Sample.

TABLE VI-A

Relationship between Test Norms Consisting of Aptitudes N, S, and M with Critical Scores of 85, 95, and 80, respectively, and the Criterion for Sample I

Carpet Layer 7-59.220
Linoleum Layer 5-32.752

N = 54

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	9	27	36
Poor Workers	13	5	18
Total	22	32	54

$r_{tet} = .68$ $\quad X^2 = 9.214$
$\sigma r_{tet} = .22$ $\quad P/2 < .005$

The data in the above table indicate a significant relationship between the test norms and the criterion for Sample I.

TABLE VI-B

Relationship between Test Norms Consisting of Aptitudes N, S, and M with Critical Scores of 85, 95, and 80, respectively, and the Criterion for Sample II

Carpet Layer 7-59.220
Linoleum Layer 5-32.752

N = 47

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	2	29	31
Poor Workers	7	9	16
Total	9	38	47

$r_{tet} = .75$ $\quad X^2 = 7.227$
$\sigma r_{tet} = .27$ $\quad P/2 < .005$

The data in the above table indicate a significant relationship between the test norms and the criterion for Sample II.

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TABLE VI-C

Relationship between Test Norms Consisting of Aptitudes N, S, and M with Critical Scores of 85, 95, and 80, respectively, and the Criteria for the Combined Sample

Carpet Layer 7-59.220
Linoleum Layer 5-32.752

N = 101

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	11	56	67
Poor Workers	20	14	34
Total	31	70	101

$r_{tet} = .66$
$\sigma r_{tet} = .17$

$X^2 = 17.125$
$P/2 < .0005$

VIII. Conclusions

On the basis of the results of this study, Aptitudes N, S, and M with minimum scores of 85, 95, and 90 respectively, have been established as B-1002 norms for the occupations of Carpet Layer 7-59.220 and Linoleum Layer 5-32.752. The equivalent B-1001 norms consist of N-90, S-100, and M-80.

IX. Determination of Occupational Aptitude Pattern

Of the existing 35 OAP's, a significant relationship between OAP-25 and the criterion for the experimental sample was obtained. The proportion of the sample screened out by OAP-25 was .26, which is within the required range of .10 to .60. Therefore, the occupations Carpet Layer 7-59.220 and Linoleum Layer 5-32.752 will be allocated to OAP-25 of the existing 35 OAP's (Revised 10/61).